

ESA-001-2 Tronox-Hamilton Pigment Plant Public Report

Introduction:

The Tronox Hamilton pigment plant in Hamilton, MS produces titanium dioxide (TiO_2) in both powdered and slurry forms. The Hamilton plant is the third-largest producer of TiO_2 in the U.S. TiO_2 is a whitener and opacifier used in the manufacture of hundreds of every day products, including paint, plastics, paper, ink, sunscreen and cosmetics. Titanium ore, chlorine, and carbon coke are principal raw materials, and the ore is received from several places in the world. A sister Tronox plant on the same site produces a different chemical and a byproduct of that process is gaseous hydrogen, H_2 . In 2001, the pigment plant added equipment to use most of this H_2 in three of the gas-fired boilers. The plant is in the process of making additional modifications to use the rest of the H_2 .

Objective of ESA:

To provide a training assessment experience targeted to reducing natural gas fuel use and expenditures.

Focus of Assessment:

The U.S. DOE qualified specialist and Tronox pigment personnel used the Steam Tools Suite to conduct an abbreviated steam system assessment of the facility. Following a safety orientation and opening meeting with all staff who would potentially be called upon for assistance/information, inputs were gathered from company information and interviews with these staff. This built upon and confirmed information already determined by the site lead prior to the ESA visit.

Approach for ESA:

SSAT model input requirements were confirmed by the site lead, Naveed Alim and staff technical specialist, Dr. David Bruce. A plant tour facilitated familiarity with boilers, distribution system and, especially, steam demands/users. Basic and typical Best Practices appeared covered, as noted below, so further evaluations, especially for plausible ways to reduce demand, were conducted. The idea of increasingly utilizing hydrogen as an alternative fuel to replace natural gas was documented. The principal staff from different areas were readily made available for discussions and exploration of ideas and this was especially helpful. They readily came to the work room in a basically "as needed" manner to assist.

One header was fed by seven boilers. Three of these boilers were principally fueled with by-product carbon monoxide (CO), with associated different acids in the feed flow; therefore, because of these complexities these "incinerator" boilers and their operating conditions were not considered for modification. The other four boilers were fired by various percentages of natural gas and hydrogen.

There are a number of standby turbines which were not considered. A condensing turbine for electricity generation was considered but rejected. Yet, further exploration for the feasibility of turbine generation, whether a condensing or backpressure type, operated from a higher pressure may be done in the future as it has been in the past.

General Observations of Potential Opportunities:

Total plant natural gas use for 2006 was over 2 billion MMBtu. Costs ranged from \$6.11 to \$11.82/MMBtu, averaging \$8.77/MMBtu. Natural gas was the impact fuel and an annual average cost was used. An impact electrical cost was not a factor in projects recommended at this plant.

Boiler stack economizers were in place for each of the four non-incinerator boilers mentioned above. Each of these four boilers had excellent stack excess oxygen ($\text{X}\%\text{O}_2$) levels of 2.5-2.6%. Traps were surveyed frequently. Line insulation was generally in place but personnel recognized the need to upgrade it and add it in some places. It was especially interesting and commendable that a pigment plant staff member is certified as a boiler thermographer to frequently look for hot spots on all seven (outside) boilers. This means that refractory condition is monitored closely and systematically repaired as necessary.

The current percentages of boiler capacities which were fired by either H_2 or natural gas were known and used to build two "base" models, one for natural gas and one for H_2 . Since all boilers feed the same header and hydrogen will always be fed at its highest possible rate rather than natural gas, all reductions in energy use, as via user demand reductions will translate into a natural gas use reduction. One large boiler is the "swing" boiler, but its output was estimated at a steady rate of 80Klb/hr. Actual peak demands, the swings, were not considered, nor were savings associated with that swing demand.

Two areas were especially investigated for user steam demand reduction. The "pick heaters" currently utilize "fresh" steam but could utilize condensate (this was not considered condensate "return" but rather a user reduction in SSAT). A rough, then more rigorous estimate by Tronox staff, of this demand reduction was made. A large steam vent was noted and lead to the quantifying of its rate which was also treated as a demand reduction.

The carbon monoxide (CO) fueled “waste heat” or “incinerator” boilers had moderately higher %XO₂ (5.1 - 5.6%) and stack temperatures (420 - 550°F) but, because of reasons mentioned above, no recommendations explicit to them were made.

No existing blowdown heat recovery led to a project for recovery via use of a feedwater heat exchanger. Even though there are several boilers, their close proximity and other current factors make this option more feasible. Incremental savings for this opportunity along with feedwater flash to the deaerator was investigated, but the latter was rejected.

The option of using H₂ as an alternative fuel at a reduced price per unit of energy is an exciting one. The alternate fuels project was exercised together with an associated increase in efficiency assuming the same stack temperature and %XO₂ as currently. Current or anticipated boiler capacities were known and used in models.

Possible % plant natural gas and net cost savings from Near, Medium and Long Term opportunities, if implemented are shown below. No significant electrical savings are anticipated as a result of these opportunities.

Near:	191,520 MMBtu / 2,590,000 MMBtu	=	\$ 817,703 / \$ 22,714,300
Medium:	378,420 MMBtu / 2,590,000 MMBtu	=	\$ 1,330,000 / \$ 22,714,300
Long:	154,140 MMBtu / 2,590,000 MMBtu	=	\$ 1,325,500 / \$ 22,714,300
TOTALS:	724,080 MMBtu / 2,590,000 MMBtu	=	\$ 3,473,203 / \$ 22,714,300

Management Support and Comments:

Pre-visit work and internal communications very helpful. Site lead and a senior technical staff were both continuously involved to facilitate this ESA.

DOE Contact at Plant/Company: Site Lead, Naveed Alim and Dr. David Bruce. (See above for all contact information.)